WATER SUPPLY OUTLOOK FOR WESTERN UNITED STATES

Including Columbia River Drainage in Canada

and

FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS

UNITED STATES DEPARTMENT of AGRICULTURE···SOIL CONSERVATION SERVICE
Collaborating with
CALIFORNIA DEPARTMENT of WATER RESOURCES
and
BRITISH COLUMBIA DEPARTMENT of
LANDS, FORESTS and WATER RESOURCES

AS OF
MAY 1, 1969

TO RECIPIENTS OF WATER SUPPLY OUTLOOK REPORTS:

Most of the usable water in western states originates as mountain snowfall. This snowfall accumulates during the winter and spring, several months before the snow melts ond appears as streomflow. Since the runoff from precipitation as snow is delayed, estimates of snowmelt runoff can be made well in advance of its occurrence. Streamflow forecasts published in this report are based principally on measurement of the water equivalent of the mountain snowpack.

Forecasts become more accurate as more of the data affecting runoff are measured. All forecasts assume that climatic factors during the remainder of the snow accumulation and melt season will interact with a resultant average effect on runoff. Early season forecosts are therefore subject to a greater change than those made on later dates.

The snow course measurement is obtained by sampling snow depth ond water equivalent at surveyed and marked locations in mountain oreas. A total of about ten samples ore taken at each location. The average of these are reported as snow depth and water equivalent. These measurements are repeated in the same location near the same dates each year.

Snow surveys are made monthly or semi-monthly from January 1 through June 1 in most states. There are about 1400 snow courses in Western United States and in the Columbia Basin in British Columbia. In the neor future, it is anticipated that automotic snow water equivalent sensing devices along with radio telemetry will provide a continuous record of snow water equivalent at key locations.

Detailed data on snow course and soil moisture measurements are presented in state and locol reports. Other data on reservoir storage, summaries of precipitation, current streamflow, and soil moisture conditions at valley elevations are also included. The report for Western United States presents a broad picture of water supply outlook conditions, including selected streamflow forecasts, summary of snow accumulotion to date, and storoge in larger reservoirs.

Snow survey and soil moisture data for the period of record are published by the Soil Conservation Service by states about every five years. Data for the current year is summarized in a West-wide basic dota summary and published about October 1 of each yeor.

PUBLISHED BY SOIL CONSERVATION SERVICE

The Soil Conservation Service publishes reports following the principal snow survey dates from January 1 through June 1 in cooperation with state water administrators, agricultural experiment stations and others. Copies of the reports for Western United States and all state reports may be obtained from Soil Conservation Service, Western Regional Technical Service Center, Room 209, 701 N. W. Glisan, Portland, Oregon 97209.

Copies of state ond local reports may also be obtained from state offices of the Soil Conservation Service in the following states:

STATE	ADDRESS
Alaska	P. O. Box "F", Palmer, Alaska 99645
Arizona	6029 Federal Building, Phoenix, Arizona 85205
Colorado (N. Mex.)	12417 Federal Building, Denver, Colorado 80521
Idoho	P. O. Box 38, Boise, Idaho 83707
Montana	P. O. Box 98, Bozeman, Montana 59715
Nevada	P. O. Box 4850, Reno Nevada 89505
Oregon	1218 S. W. Washington St., Portland, Oregon 97205
Utah	4012 Federal Building, Salt Lake City, Utah 84111
Washington	360 U.S. Court House, Spokane, Washington 99201
Wyoming	P. O. Box 340, Casper, Wyoming 82602

PUBLISHED BY OTHER AGENCIES

Water Supply Outlook reports prepared by other agencies include a report for California by the Water Supply Forecast and Snow Surveys Unit, California Department of Water Resources, P. O. Box 388, Sacramento, California 95802 --- and for British Columbia by the Department of Lands, Forests and Water Resources, Water Resources Service, Parliament Building, Victoria, British Columbia

USDA-SCS-PORTLAND, OREG. 1966

WATER SUPPLY OUTLOOK FOR WESTERN UNITED STATES

Including Columbia River Drainage in Canada

ISSUED

MAY 1, 1969

The Soil Conservation Service coordinates snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Corps of Engineers, Forest Service, National Park Service, Weather Bureau, Geological Survey, and other Federal Agencies, Departments of State Government, Irrigation Districts, Power Companies, and others.

The Department of Water Resources coordinates snow surveys in California.

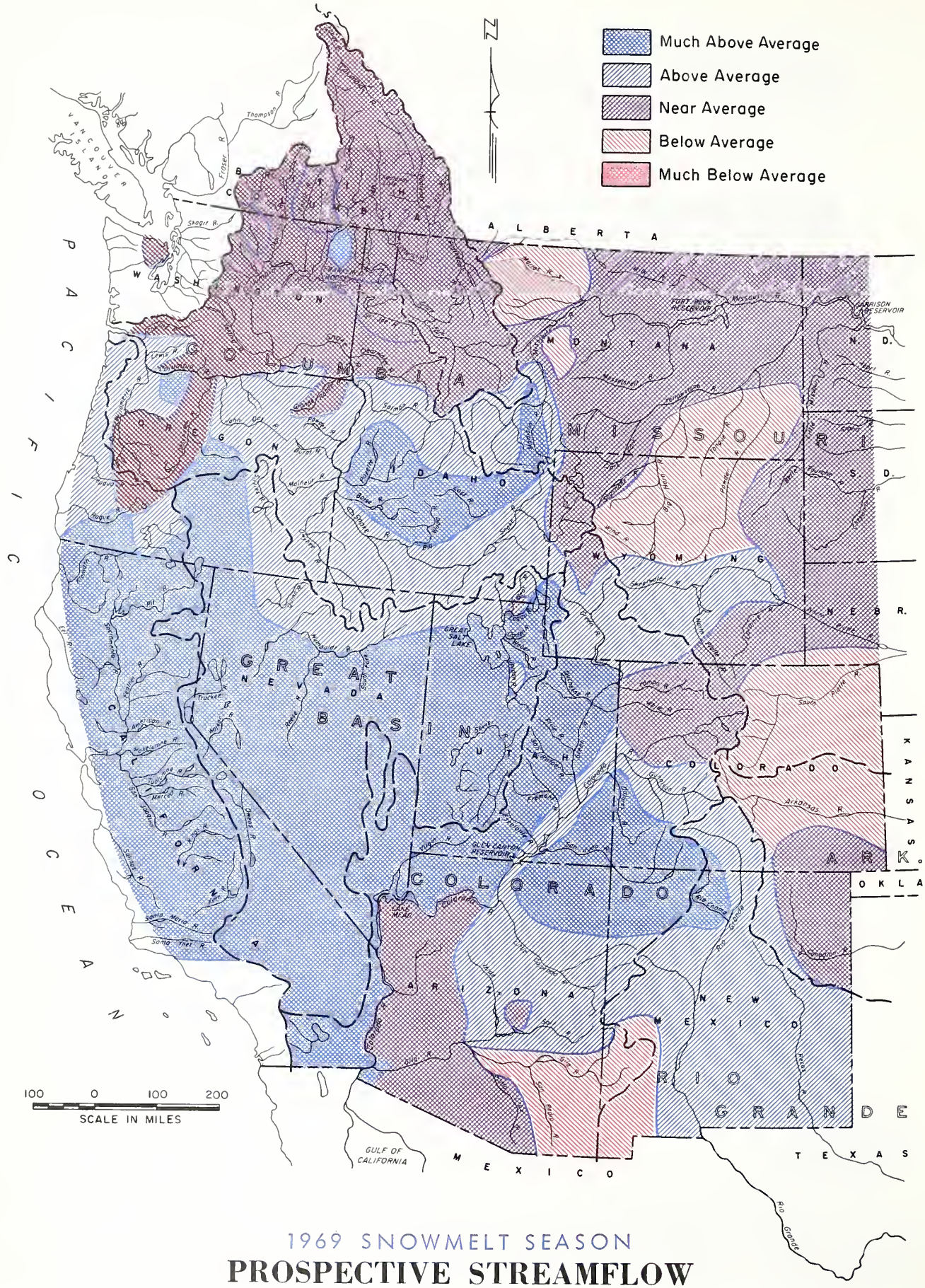
The Water Resources Service, Department of Lands, Forests, and Water Resources directs snow surveys in British Columbia.

This report was prepared by the Water Supply Forecasting Branch, Engineering Division, Soil Conservation Service, from data supplied by Snow Survey Supervisors of the Soil Conservation Service in the States of Alaska, Arizona, Colorado and New Mexico, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

Data from California was supplied by the Chief, Water Supply Forecast and Snow Survey Unit, Department of Water Resources.

Data from British Columbia was supplied by the Chief, Hydrology Division, Water Investigations Branch, Department of Lands, Forests and Water Resources.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENNETH E. GRANT, ADMINISTRATOR



1969 SNOWMELT SEASON

PROSPECTIVE STREAMFLOW

AS OF MAY 1, 1969

USDA-SCS-PORTLAND, OREG. 1969

WATER SUPPLY OUTLOOK

969 SNOWMELT SEASON
AS OF MAY 1, 1969

IRRIGATION WATER SUPPLY FOR 1969 REMAINS GOOD TO EXCELLENT FOR MOST WESTERN AREAS. MINOR LATE SUMMER DEFICIENCIES ARE EXPECTED IN EASTERN COLORADO, NORTHWESTERN AND SOUTHEASTERN MONTANA, WITH SEVERE SHORTAGES ANTICIPATED ALONG THE EASTERN SLOPE OF WYOMING'S BIG HORN MOUNTAINS. EXTRA PUMPING TO OFFSET LOW STREAM SUPPLIES STILL REQUIRED ALONG ARIZONA'S GILA RIVER. POTENTIAL HIGH WATER PROBLEMS IN LOCALIZED AREAS STILL POSSIBLE IN AREAS OF CALIFORNIA, NEVADA, UTAH AND SOUTHERN IDAHO.

Very light April snowfall over much of the west eased high water potentials in southern Idaho, eastern Nevada, Utah and southwestern Colorado. It increased the probability of late season shortages in eastern Colorado, north central Wyoming, southeastern and northwestern Montana. Above normal April precipitation in central California, parts of Washington and most of British Columbia raised forecasts of snowmelt runoff this season.

Unseasonably warm temperatures which caused heavy melting of low and intermediate elevation snowpacks was common throughout much of the West. This heavy melting showed up in the rivers, as reported by the U. S. Geological Survey. April flows of 150 to 250 percent of average were common in the Columbia, Missouri, Colorado and Great Basins. In parts of southeastern Oregon, southern Idaho and western Nevada streamflow was in excess of four and five times average amounts, causing localized flooding in places. The Owyhee river furnishes an example of the heavy depletion of snow from low elevation watersheds. Its April 1st snowpack was 203 percent average, but fell to 66 percent average on May 1. Flow of the river was reported at 426 percent average.

Density of the snow on April 1 was considerably higher than normal, generally near May 1st averages. This high density, combined with the above normal temperatures, caused snowmelt to proceed more rapidly than usual. Fortunately, cool spells occurred at appropriate times to keep low elevation streams from reaching their full high water potential.

The California Department of Water Resources reports that April's near and above normal precipitation in the major snow accumulation regions of the State makes certain that California's snowmelt streams will experience the heaviest April-July runoff of recent time. High snowmelt flows will continue well into June in the Central Valley area and major conservation reservoirs on snow-fed streams are expected to fill.

Local, State and Federal agencies are continuing their efforts to keep lowland flooding to a minimum in California's Tulare Lake Basin. In spite of all that could be accomplished, some 79,000 acres of the finest agricultural lands in California (the drained Tulare Lake area) were flooded by the surplus water from watersheds feeding this basin. Considerably more water will still have to be accommodated before the snowmelt runoff is over. The agricultural interests and the economy of the entire area have suffered a severe blow, the full effect of which will not be realized until the inundated area is fully reclaimed--an accomplishment that may be three years away.

The British Columbia Water Resources Service reports that flow of the Columbia and Kootenai rivers is expected to be near but slightly below average. Streams in Oregon, Washington, northern Idaho and western Montana (Columbia Basin drainages) should yield near or above average flows. Streams in Idaho from the Salmon river and southward are expected to yield above average to much above average flows during the remainder of the snowmelt season.

East of the Continental Divide in Montana water supplies will be above average in the Missouri river headwaters. Late season supplies should be adequate in most of the state, with a possibility of minor shortages on streams originating in the Castle, Little Belt, Big Belt and Snowy mountains.

SUMMARY OF SNOW WATER EQUIVALENT MEASUREMENTS MAY 1, 1969

MAJOR BASIN AND SUB—WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
MISSOURI BASIN		
Jefferson	92	98
Madison	83	95
Gallatin	62	84
Missouri Main Stem	64	67
Yellowstone	65	76
Shoshone		
Wind	90	88
North Platte	76	89
South Platte	61	66
ARKANSAS BASIN		
Arkansas	52	75
Canadian	--	--
RIO GRANDE BASIN		
Rio Grande (Colo.)	70	104
Rio Grande abv. Otowi Bridge	82	127
Pecos	--	--
COLORADO BASIN		
Green (Wyo.)	78	74
Yampa - White	58	78
Duchesne	80	134
Price	67	128
Upper Colorado	58	73
Gunnison	62	89
San Juan	91	119
Dolores	73	146
Virgin	132	472
Gila	--	--
Salt	--	--
GREAT BASIN		
Bear	76	101
Logan	65	78
Ogden	119	159
Weber	74	117
Provo - Utah Lake	66	123
Jordan	68	118
Sevier	83	214
Walker - Carson	352	219
Tahoe - Truckee	384	210
Humboldt	--	107
Lake Co. (Oregon)	--	161
Harney Basin (Oregon)	--	42
UPPER COLUMBIA BASIN		
Columbia (Canada)	80	90
Kootenai	90	80
Clark Fork	94	85
Bitterroot	88	83
Flathead	93	80
Spokane	138	104
Okanogan	97	93
Methow	154	111
Chelan	104	97
Wenatchee	231	132

MAJOR BASIN AND SUB—WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
SNAKE BASIN		
Snake above Jackson, Wyo.	97	87
Snake above Hiese, Idaho	90	85
Snake abv. American Falls Res.	95	88
Henry's Fork	123	94
Southern Idaho Tributaries	110	89
Big and Little Wood	193	133
Boise	180	110
Owyhee	--	66
Payette	154	109
Malheur	--	57
Weiser	128	75
Burnt	--	37
Powder	107	80
Salmon	132	110
Grande Ronde	243	100
Clearwater	105	86
LOWER COLUMBIA BASIN		
Yakima	568	137
Umatilla	1270	80
John Day	840	66
Deschutes - Crooked	236	110
Hood	360	135
Willamette	310	126
Lewis	402	145
Cowlitz	233	119
PACIFIC COASTAL BASIN		
Puget Sound	172	104
Olympic Peninsula	187	112
Umpqua - Rogue	302	127
Klamath	344	134
Trinity	340	205
CALIFORNIA CENTRAL VALLEY		
Upper Sacramento	315	190
Feather	430	215
Yuba	360	215
American	540	215
Mokelumne	540	215
Stanislaus	640	225
Tuolumne	820	245
Merced	900	270
San Joaquin	920	275
Kings	780	310
Kaweah	890	355
Tule	430	170
Kern	700	350

Data for California Watersheds supplied by Dept. of Water Resources, and for British Columbia Watersheds by Dept. of Lands, Forests and Water Resources.

Average is for 1953-67 *period.* California averages are for the period 1931-65.
Based on Selected Snow Courses determined by Distribution within the Basin, Length of Record and Repetitive Monthly Measurement Schedules.

Severe water shortages are expected by users without reservoir storage along Wyoming's streams heading on the east slope of the Big Horn mountains. Some shortages are anticipated on the upper Wind river and along the west slope of the Big Horns. Average or greater flows will come from other Wyoming streams, including the Yellowstone, Snake, Green, Laramie and North Platte rivers.

Carryover storage on the South Platte river in Colorado is good and will help to offset the effect of low streamflow forecasts. Some shortages are in prospect along the Arkansas river where 10 to 15 percent less than average flow is forecast. Principal problem here is the 36 percent of average storage in John Martin reservoir. In New Mexico the Canadian river will furnish normal supplies, while the Pecos and Rio Grande rivers will yield above average to much above average runoff.

In the Colorado river basin the upper Green in Wyoming, along with the Yampa, White and upper Colorado rivers in Colorado should all yield near or a little above average snowmelt water. Forecasts for the southwest Colorado and Utah tributary streams range from 119 percent on the Gunnison river to 340 percent average on Utah's Virgin river. With over 90 percent of Arizona's snowmelt runoff having already occurred and reservoir storage at 180 percent average, the water supply outlook remains very good except along the upper Gila river where considerable pumping will be required.

In the Great Basin, Utah's Logan river is the only stream forecast to yield average water supplies. Heavy runoff occurred during April from northern tributaries to Nevada's Humboldt river, causing localized flooding on several small streams. Here, as elsewhere in the west, warm spells were interspersed with cool periods which kept runoff from low elevation watersheds from getting too far out of control. Flow of western Nevada streams coming from the Sierra's will be in excess of twice normal amounts. Forecasts of most northern Utah streams range from about 130 percent to near 200 percent, while in central and southern sections near one and a half well over twice normal is anticipated.

MISSOURI BASIN

Light April snowfall, combined with unseasonably warm temperatures caused heavy melting of the low and intermediate elevation snowpack. In general, the high elevation snow remained about the same as last month, failing to get normal increases. Reflecting the heavy melting conditions, streamflow was high for the month, as typified by Montana streams which were reported as flowing at 150 to 250 percent average.

In Montana water supplies will be above average in the Missouri river headwaters, but below average in the Smith, Dearborn, Sun, Teton and Marias river drainages. Late season supplies should be adequate, with possible minor shortages on streams originating in the Castle, Little Belt, Big Belt and Snowy mountains.

Flow of the Yellowstone river in Wyoming and Montana should be near average. Some shortages are expected along Wyoming's upper Wind river and on most streams heading in the Big Horn mountains. Water users without storage facilities along the east side of the Big Horns can expect severe shortages during mid and late summer months. The Laramie and North Platte rivers will supply average to near 15 percent above average water.

Based on May 1st snow surveys, forecasts on the South Platte and its northern tributaries range from a low of 66 percent normal on the St. Vrain to a high of 80 percent on the Big Thompson. Carryover reservoir storage on the South Platte is good and will buffer the effect of the low streamflow. Also, heavy rains in the valley and snow in the mountains during early May have improved streamflow prospects and provided a good irrigation for farm lands. This will save more reservoir water for use later in the summer.

ARKANSAS BASIN

Dry April weather reduced streamflow prospects for the Arkansas river and its tributaries. Present outlook is for about 10 to 15 percent less than average flow on the main river in Colorado, with near average flows coming from southern tributaries such as the Purgatoire. Since storage in John Martin reservoir is only 36 percent of average, some water shortages are anticipated this summer.

In New Mexico the Canadian river is expected to produce average supplies. However, since storage in Conchas reservoir is 74 percent average, a wetter than normal summer would be welcome.

RIO GRANDE BASIN

April snowfall in headwater areas of both Colorado and New Mexico was only about one-half normal for April, dropping forecasts about 10 percent. The Rio Grande and its tributaries are still expected to flow at well above average amounts, ranging from 112 percent for the Rio Grande near Del Norte to 160 percent for inflow to El Vado reservoir. April storms were better on the Pecos river and it is still expected to produce above average supplies this summer.

SELECTED STREAMFLOW FORECASTS MAY - SEPTEMBER 1969 as of MAY 1, 1969

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
UPPER MISSOURI	1968	1969	
Jefferson at Sappington, Montana	879	1095	135
Madison near Grayling, Montana 1/	469	520	138
Gallatin near Gateway, Montana	615	520	118
Missouri near Landusky, Montana 2/	4051	4120	104
Sun at Gibson Dam, Montana 3/	409	475	83
Marias near Shelby, Montana 4/	345	380	72
Milk near Eastern Crossing, Montana	248	212	97
Yellowstone at Yellowstone Lake Outlet, Wyo. (Apr-Oct.)		920	110
Yellowstone at Corwin Springs, Montana	2037	1810	100
Clark Fork at Chance, Montana	555	540	96
Shoshone, Inflow to Buffalo Bill Res., Wyo*		810	100
Wind at Dubois, Wyoming *		79	80
Bull Lake near Lenore, Wyoming*		169	95
Tensleep near Tensleep, Wyoming*		62	84
Yellowstone at Miles City, Montana 5/	6985	5060	93
Missouri near Williston, N. Dakota 6/	11668	9200	95
PLATTE			
North Platte at Saratoga, Wyoming*		615	111
Laramie near Jelm, Wyoming 7/*		104	100
Clear at Golden, Colorado*		92	77
St. Vrain at Lyons, Colorado*		46	66
Cache LaPoudre near Fort Collins, Colorado 8/*		165	77
ARKANSAS			
Arkansas at Salida, Colorado 9/*		275	89
Purgatoire at Trinidad, Colorado*		45	98
RIO GRANDE			
Rio Grande near Del Norte, Colorado 10/*		490	112
Conejos near Mogote, Colorado 11/*		230	126
El Vado Res. Inflow, New Mex. (Mar-July)		300	160
Rio Grande at Otowi Bridge, New Mexico 12/(Mar-July)		700	136
Pecos at Pecos, New Mexico (Mar-July)		55	134
UPPER COLORADO			
Granby Reservoir Inflow, Colorado 13/ *		210	96
Colorado at Dotsero, Colorado 14/ *		1470	107
Roaring Fork at Glenwood Springs, Colorado 15/*		750	108
Gunnison at Grand Junction, Colorado 16/*		1350	119
Dolores at Dolores, Colorado*		335	145
Colorado near Cisco, Utah 16/**	3653	3412	122
Flaming Gorge Res , Utah, Net Inflow 17/**	1061	1185	112
Yampa at Steamboat Springs, Colorado*		250	96
White at Meeker, Colorado *		280	96
Duchesne near Tabiona, Utah 18/***	108	137	161
Whiterocks near Whiterocks, Utah ***	73	64	133
Scofield Reservoir, Utah, Net Inflow 19/***	40	55	204
Green at Green River, Utah 17/**	1796	3084	120
Navajo Reservoir Inflow, New Mexico **	591	940	152
Animas at Durango, Colorado*		545	133
San Juan near Bluff, Utah 20/**	923	1349	152
Colorado, Inflow to Lake Powell, Arizona 21/**	7247	8315	127
LOWER COLORADO			
Gila near Solomon, Arizona (May)	44	7	74
Salt at Intake, Arizona (May)	83	45	123
Verde above Horseshoe Dam, Arizona (May)	17	10	111

SELECTED STREAMFLOW FORECASTS MAY - SEPTEMBER 1969 as of MAY 1, 1969

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
GREAT BASIN	1968	1969	
Bear at Harer, Idaho ***	172	260	167
Logan near Logan, Utah 22/ ***	89	85	99
Ogden, Inflow to Pine View Res., Utah 23/ ***	68	114	181
Weber near Oakley, Utah ***	130	137	137
Utah Lake, Utah, Net Inflow ***	187	235	179
Big Cottonwood near Salt Lake City, Utah ***	35	37	123
Beaver near Beaver, Utah ***	28	30	181
Sevier near Hatch, Utah ***	49	61	226
Humboldt at Palisades, Nevada ***	69	150	123
Truckee at Farad, California 26/***	103	420	222
East Carson near Gardnerville, Nevada ***	92	300	210
West Walker near Coleville, California ***	77	275	220
UPPER COLUMBIA			
Columbia at Revelstoke, British Columbia	19390	16200	92
Kootenai at Wardner, British Columbia	4275	4400	94
Kootenai at Leonia, Idaho	7481	8400	100
Flathead near Columbia Falls, Montana 27/	5168	5750	98
Flathead near Polson, Montana 27/	6041	7030	101
Clark Fork above Missoula, Montana	1277	1620	104
Bitterroot near Darby, Montana	502	505	100
Clark Fork at Plains, Montana 27/	9665	11570	104
Columbia at Birchbank, British Columbia 27/	44610	41400	95
Spokane at Post Falls, Idaho 28/	1318	2500	118
Columbia at Grand Coulee, Washington 27/	58640	64000	102
Okanogan near Tonasket, Washington	1486	1720	107
Chelan at Chelan, Washington 29/		1230	107
Wenatchee at Peshastin, Washington	1384	1700	106
SNAKE			
Snake above Palisades Res., Wyoming 30/*		2640	103
Snake near Heise, Idaho 30/	3454	3500	103
Henry's Fork near Rexburg, Idaho 31/	1251	1280	116
Big Lost near Mackay, Idaho 32/	145	290	182
Big Wood, Inflow to Magic Res., Idaho 33/***		290	180
Bruneau near Hot Springs, Idaho	91	165	116
Owyhee Res., Net Inflow, Oregon	74	200	112
Boise near Boise, Idaho 34/		1650	134
Malheur near Drewsey, Oregon		25	74
Payette near Horseshoe Bend, Idaho 35/	998	2000	132
Snake at Weiser, Idaho	3516	5800	116
Salmon at Whitebird, Idaho	5026	7500	121
Clearwater at Spalding, Idaho	5678	7200	106
LOWER COLUMBIA			
Grande Ronde at LaGrande, Oregon	32	108	103
Yakima at Cle Elum, Washington 36/		790	100
Deschutes at Benham Falls, Oregon 37/		425	83
Columbia at The Dalles, Oregon 27/	80470	100000	109
Hood near Hood River, Oregon 37/		319	131
Willamette at Salem, Oregon 37/ *		5199	100
Lewis at Ariel, Washington 38/		1100	115
Cowlitz at Castle Rock, Washington		2110	100

SELECTED STREAMFLOW FORECASTS MAY - SEPTEMBER 1969 as of MAY 1, 1969

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
	1968	1969	
NORTH PACIFIC COASTAL			
Dungeness near Sequim, Washington		153	100
Rogue at Raygold, Oregon		719	105
Klamath Lake, Net Inflow, Oregon	191	420	109
CALIFORNIA CENTRAL VALLEY 39/**			
Sacramento, Inflow to Shasta, California	1277	2400	137
Feather near Oroville, California	1141	3800	204
Yuba at Smartville, California	568	1860	171
American, Inflow to Folsom Res., Calif.	610	2400	181
Cosumnes at Michigan Bar, California	45	270	211
Mokelumne, Inflow to Pardee Res., Calif.	241	900	194
Stanislaus, Inflow to Melones Res., Calif.	389	1450	204
Tuolumne, Inflow to Don Pedro Res., Calif.	648	2500	212
Merced, Inflow to Excheque Res., Calif.	274	1340	224
San Joaquin, Inflow to Millerton Lake, Calif.	552	3180	271
Kings, Inflow to Pine Flat Res., California	548	3000	262
Kaweah, Inflow to Terminus Res., California	131	800	307
Tule, Inflow to Success Res., California	21	220	393
Kern, Inflow to Isabella Res., California	232	1800	439

Forecasts in California provided by Department of Water Resources.
Average is for 1953-67 period except California. California is computed for 1916-65 period.
Forecasts assume average Effective Climate Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts listed on Inside Back Cover.
**April - September Period **April - July Period ***May - July Period.*

Although total reservoir storage is below normal, the above normal streamflow will more than offset this. The entire basin should have good water supplies this summer.

COLORADO BASIN

Very light snowfall and unseasonably warm temperatures which caused heavy melting of low and intermediate elevation snowpack was characteristic throughout most of the Colorado river basin. This heavy melting showed up in the rivers, as illustrated by the U. S. Geological Survey's adjusted April discharge figures for the three main tributaries, as follows: Colorado near Cisco - 184 percent; Green near Green River, Utah - 156 percent and San Juan near Bluff - 150 percent.

Adequate to excellent water supplies are still expected in all sections of the upper Colorado Basin. The Green river and its Wyoming tributaries, along with the Yampa, White and upper Colorado rivers in Colorado should all yield near or a little above average snowmelt flows. Forecast flow of the Gunnison, Dolores and San Juan rivers in central and southern Colorado and all Utah tributaries of the upper basin ranges from 119 percent for the Gunnison to over twice normal on Utah's Price river.

In the lower Colorado Basin, Utah's Virgin river still carries an exceptionally heavy snowpack and is forecast at 340 percent average. In Arizona the water supply outlook remains very good except along the upper Gila river. With over ninety percent of the spring runoff having already occurred, remaining snowmelt runoff will have little significance in changing the water picture. Reservoir storage is 180 percent of average. Only heavy summer rains could improve the outlook for the Gila river. Considerable pumping will be required to offset the low streamflow outlook.

GREAT BASIN

The water outlook for the entire Great Basin remains good to excellent, in spite of very dry, warm April weather experienced in most areas except along the eastern slopes of the Sierra's and southern Cascades. In this latter area precipitation was near or above average.

The warm temperatures produced heavy runoff from low elevation snowpacks, extending to intermediate elevations on south facing water-

sheds. The warm spells were interspersed with cool periods which produced favorable melting rates for managing the flows in most areas of Utah and western Nevada. However, conditions were not so favorable in northeastern Nevada where localized flooding occurred on several small streams, with over 500 percent average flows on the major streams. The snowpack in the Harney Basin in Oregon has sustained heavy melting and is presently only 42 percent average. Runoff here has also been heavy. Lake County, Oregon still has a heavy snow cover (161 percent).

Northern tributaries of the Humboldt river have already yielded most of their snowmelt water, while southern tributaries still hold the major part of their potential contribution. Remaining flow of the Humboldt during the May-July period is expected to be 123 percent average. In western Nevada the Truckee, Walker and Carson rivers are all forecast to yield in excess of twice normal flows.

In Utah the lowest streamflow forecast is 99 percent average on the Logan river with other forecasts ranging upward from here to 248 percent for the Spanish Fork river and about four times average on the Sevier river below Piute Dam. Forecasts for most northern Utah streams range from about 130 percent to near 200 percent, while in central and southern sections the forecast range is generally from about 150 percent to 225 percent.

Storage water in reservoirs is well above average except in those reservoirs which are holding space for heavy flows yet to come. Utah Lake is above Compromise and should receive a May-July inflow near 180 percent average.

COLUMBIA BASIN

Water supply outlook for the 1969 summer season continues good to excellent for all parts of the Columbia Basin and adjacent Pacific Northwest watersheds.

The British Columbia Water Resources Service reports that flow of the Columbia and Kootenai rivers is expected to be near but slightly below average. Above normal melting conditions in British Columbia during April were largely offset by considerably greater than average monthly snowfall, leaving the total snowpack only a few percentage points lower than on April 1st. However, here as elsewhere throughout the Columbia Basin, abnormally heavy depletion of the low elevation snowpack occurred. April snowfall was generally near or above normal in northern Idaho, in northeastern Oregon, and in Washington except as noted below. Snowfall was very light in central and southern Idaho, central and southwestern Oregon. It was below average in Wyoming and in Washington on the Yakima, Wenatchee and Chelan watersheds as well as the southwest slopes of the Cascades.

The abnormally heavy snowpack depletion was particularly noticeable in southeastern Oregon and southern Idaho where it extended well into intermediate elevations. Examples illustrating the changes which have occurred include the Owyhee river where last month's snowcover was 203 percent average compared to the present 66 percent average, and the Burnt river at 128 percent on April 1st with only 37 percent now.

Density of the snow on April 1st was considerably higher than normal, generally near May 1st averages. April temperatures were generally above normal through much of the Columbia Basin. These two factors combined to make melting proceed more rapidly than usual.

The snow cover on the Big and Little Lost, Big and Little Wood rivers and on the Camas-Beaver Creek drainage in Idaho is still extremely heavy. The low elevation snow cover on these drainages melted during April and produced extremely high flows, but a cool spell retarded snowmelt. This highly desirable weather change lowered the flood hazard, but has not completely eliminated it. Some low elevation streams yielded well over four times average amounts.

In Montana's portion of the Columbia Basin the April runoff was generally 150 to 200 percent average. Runoff for the remainder of the summer is expected to be near average on the Kootenai, Blackfoot, Bitterroot, Flathead rivers and their tributary streams. Above average flows are expected in the headwaters of the Clark Fork and on tributary streams to the lower Clark Fork.

Flow of Oregon, Washington and northern Idaho streams during the remainder of the season is expected to be near or above average. From the Salmon river and southward in Idaho, streams are expected to yield above average to much above average flows.

Reservoir storage is generally above average. Power reservoirs on the main stem Columbia and tributaries have above normal amounts of water in storage as a result of early filling to maintain the low water elevation in FDR Lake. Construction at the third power house should permit the reservoir to start filling about the middle of May.

ALASKA

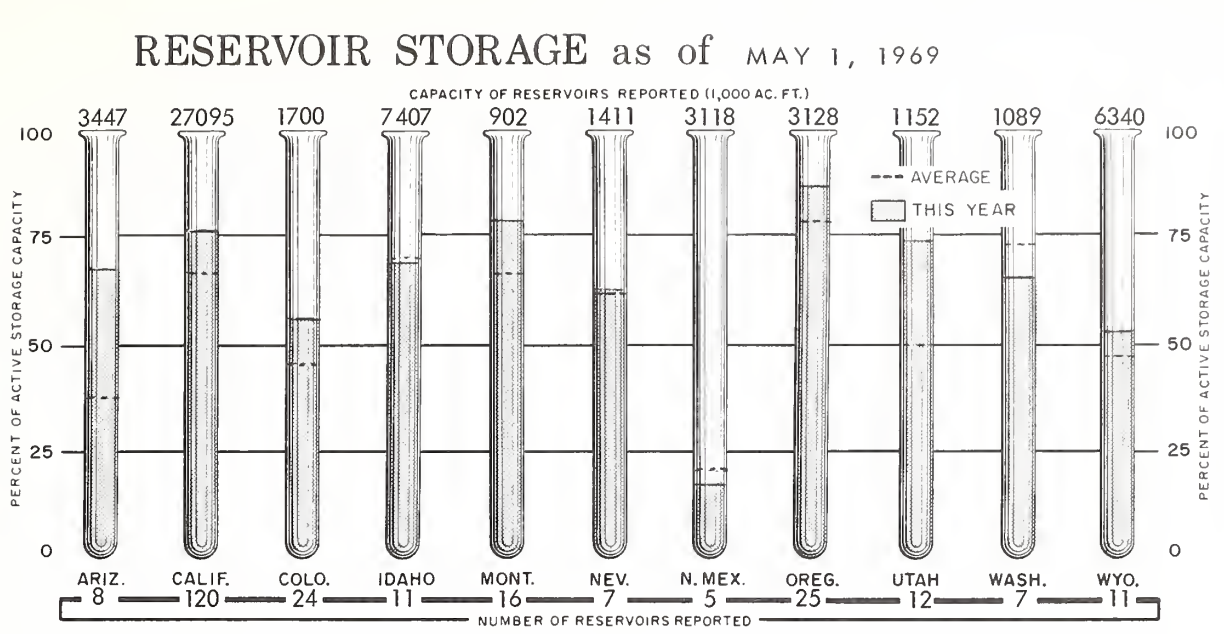
Low elevation snow cover has melted in most areas of Alaska. In the interior portions of

STORAGE IN LARGE RESERVOIRS MAY 1, 1969

BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)
UPPER MISSOURI		
Belle Fourche	185	161
Boysen	550	262
Buffalo Bill	373	162
Canyon Ferry	2043	1603
Fort Peck	19410	16950
Garrison	24500	20220
Hebgen	377	294
Keyhole	340	130
Lake Francis Case	5816	4362
Lake Sharp	1900	1735
Oahe	23630	21986
Tiber	1347	546
Yellowtail	1356	779
PLATTE		
City of Denver (5)	507	418
Colo-Big Thompson (3)	718	349
Glendo	784	473
Pathfinder	1016	378
Seminoe	1011	447
ARKANSAS		
Conchas	273	111
John Martin	354	25
RIO GRANDE		
Elephant Butte	2195	344
El Vado	195	4
UPPER COLORADO		
Blue Mesa	830	362
Flaming Gorge	3749	1712
Navajo	1696	733
Powell	25002	8049
LOWER COLORADO		
Havusu	619	595
Mead	27207	15476
Mohave	1810	1710
Salt River Res. (4)	1755	1634
San Carlos	1206	412
Verde River Res. (2)	318	241
GREAT BASIN		
Bear	1421	1166
Lahontan	287	176
Rye Patch	172	120
Sevier Bridge	236	166
Strawberry	265	176
Tahoe	732	732
Utah	884	922
Willard Bay	198	144

BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)
UPPER COLUMBIA		
Chelan	676	229
Coeur d'Alene	225	442
Duncan	1347	105
Flathead	1219	1266
Hungry Horse	2982	2044
Kootenay	673	787
Lower Arrow	3083	643
Pend Oreille	1155	737
Roosevelt	5232	-1864
Upper Arrow	4061	574
LOWER COLUMBIA		
Cougar	155	129
Detroit	299	242
Hills Creek	200	141
Lookout Point	337	227
Yakima Res. (5)	1066	798
SNAKE		
American Falls	1700	1707
Anderson Ranch	423	281
Arrowrock	287	271
Brownlee	980	376
Cascade	653	314
Jackson	847	591
Lucky Peak	278	51
Owyhee	715	701
Palisades	1202	782
PACIFIC COASTAL		
Clair Engle	2500	2057
Clear Lake	440	330
Nacimiento	350	202
Ross	1052	546
Upper Klamath	584	556
CALIFORNIA CENTRAL VALLEY		
Almanor	1036	742
Berryessa	1602	1612
Folsom	1010	581
Isabella	570	173
McClure	1026	696
Millerton	521	137
Oroville	3484	3014
Pine Flat	1013	581
Shasta	4500	4394

Reservoir Storage Data Provided by Bureau of Reclamation, Corps of Engineers, Geological Survey, and water using organizations. Data from California and British Columbia provided by Department of Water Resources and Department of Lands, Forests and Water Resources, respectively.



the state the snowpack is also considerably reduced at higher elevations. Many snow courses which normally have a good cover on May 1st are bare this year.

Soils were very dry in most of interior Alaska. Consequently water from the low elevation snowpack has been almost completely absorbed by the soil, with very little runoff resulting. Major runoff from snowmelt will come from the higher portions of the mountains and will not show up in the streams until late May or June.

Watersheds of the Chena, Tanana, Susitna, Copper and 40 Mile rivers are particularly dry this year. Spring and early summer streamflow in these areas is expected to be substantially below normal. Mid April storms brought heavy snowfall to the mountains of the Kenai peninsula and southeast Alaska. These areas have had greater than average snow throughout most of the winter and will produce good streamflow.

CALIFORNIA

The California Department of Water Resources, coordinating agency for snow surveys and water supply forecasting in California, reports that heavy precipitation during April through the central portion of the State brought additional contributions to California's already abundant water supplies. Extensive May 1 surveys of snow courses in the central and southern Sierras and the key snow courses throughout the State indicated that this areas's exceptional snowpack still had 185 percent of its April 1 average water content. Runoff forecasts for snow-fed streams during the April-July period are all much above average and indicate streamflows this year will range among the highest of record.

High snowmelt flows will persist well into the summer; however, unusual seepage is not expected to occur in the Sacramento Valley but there will be continued flooding in some low lying land in the San Joaquin Valley. Local, State and Federal agencies are continuing their efforts to keep lowland flooding to a minimum in the Tulare Lake Basin. This will be accomplished by diversion, increased ground water recharge, maximum water use and by pumping water back through the California Aqueduct to other areas needing water for irrigation. Still, some 79,000 acres of the finest agricultural lands in California (the drained Tulare Lake area) were flooded by the surplus water from watersheds feeding this basin. Tulare Lake on April 1 contained 750,000 acre-feet of water and the current estimate, based on the latest April-July water forecasts, is that approximately one-half million acre-feet more inflow primarily from the Kern River will have to be accommodated in the Tulare Lake and Buena Vista Lake system. The agricultural interests and the economy of the entire area have suffered a severe blow, the full effect of which will not be realized until the inundated area is fully reclaimed -- an accomplishment that may be three years away.

Precipitation during April was generally above normal across the central portions, normal in the north, and below normal in the Lahontan area and that of the Tehachapi

mountains. Two major storms moved across California in April with one, in the first week, being state-wide in scope, the second in the latter half of the month was limited to areas north of the Tehachapi mountains. Precipitation for the entire State was about 75 percent of average for the month and 155 percent of average for the period October 1 to April 30.

The Sierra snowpack was at record and near record water content on April 1 and is now 245 percent of average for this time. This is the greatest snowpack water content ever recorded on May 1. With near normal temperature and the absence of any prolonged hot periods, the melting of the low elevation snowpack has been steady rather than spectacular. It is being rapidly depleted, however, below the 6,000 foot elevation while at higher elevations little melt had occurred prior to May 1 surveys.

Runoff of California streams during April was above normal in all areas except for the San Francisco Bay area which was 80 percent of normal. Once again, for the fourth consecutive month, the major runoff flow with respect to normal occurred in the southern coastal area where key streams averaged 230 percent of normal for the month. Runoff from Sacramento and San Joaquin Valley tributaries remained high, averaging 150 to 200 percent of normal, respectively. During April runoff from all California watersheds was about 150 percent of normal, making the season to date total equal to 170 percent of normal.

May 1 forecasts for April-July runoff for California snowmelt streams are generally the same as those reported one month ago except for tributaries to the San Joaquin Valley which were revised upward slightly. Based upon the presumption that normal precipitation will occur during the remainder of the season, streams tributary to the Sacramento and San Joaquin valleys are expected to be 175 percent and 235 percent of April-July average, respectively.

Water stored in California's major reservoirs on May 1, 1969 was about 110 percent of average for that date and about 70 percent of capacity. The necessity for maintaining flood control reservation for snowmelt runoff placed a limitation on increases in storage, particularly on eastern tributaries to the Central Valley.

EXPLANATION of STREAMFLOW FORECASTS

All flows are observed flows except as adjusted for: 1/ Change in storage in Hebgen Lake. 2/ Change in storage in Canyon Ferry and Tiber reservoirs. 3/ Change in storage in Gibson Reservoir and measured diversions. 4/ Change in storage in Two Medicine, Four Horns and Lake Francis reservoirs. 5/ Change in storage in Boysen and Buffalo Bill reservoirs.

6/ Change in storage in Boysen, Buffalo Bill, Canyon Ferry, Tiber, and Fort Peck reservoirs. 7/ Plus diversions to Cache la Poudre. 8/ Minus diversions from North Platte, Laramie, and Colorado rivers plus measured diversions above station. 9/ Change in storage in Twin Lakes and Sugar Loaf reservoirs minus diversions from Colorado River. 10/ Change in storage in Rio Grande, Santa Maria, and Continental reservoirs.

11/ Change in storage in Platoro Reservoir. 12/ Change in storage in El Vado Reservoir. 13/ Change in storage in Granby Reservoir plus diversions to Cache la Poudre and through Adams Tunnel. 14/ Changes as indicated in (13) plus Moffat Tunnel diversion. 15/ Plus diversions to Arkansas River.

16/ Change in storage in Blue Mesa reservoir. 17/ Change in storage in Flaming Gorge, Fontenelle and Big Sandy reservoirs. 18/ Plus diversion through Duchesne Tunnel. 19/ Change in storage in Scofield Reservoir. 20/ Change in storage in Navaho Reservoir.

2 21/ (Lee's Ferry) Change in storage in Flaming Gorge, Navajo, Lake Powell and Big Sandy reservoirs. 22/ Plus Utah Power and Light Company tailrace and and Logan, Hyde Park, and Smithfield canals. 23/ (Inflow record computed by U. S. Bureau of Reclamation.) 24/ Plus diversion by Weber-Provo Canal and change in storage in Wanship Reservoir. 25/ Change in storage in Deer Creek Reservoir, minus diversions through Duchesne Tunnel and Weber-Provo Canal, plus diversion through Salt Lake City Aqueduct.

26/ Change of storage in Lake Tahoe and Boca Reservoir. (Forecast by Truckee Basin Committee) 27/ Change in storage in any of these reservoirs above the station: Kootenai Lake, Hungry Horse, Flathead Lake, Pend Oreille Lake, F. D. Roosevelt Lake, Lake Chelan, Coeur d'Alene Lake, Brownlee and Noxon; and pumpage at Roosevelt Lake. 28/ Changes in storage in Coeur d'Alene Lake and diversions by Spokane Valley Farms Company and Rathdrum Prairie canals. 29/ Change in storage in Lake Chelan. 30/ Changes in storage for Jackson Lake and Palisades Reservoir above stations. 30/

31/ Change in storage in Henry's Lake, Island Park and Grassy Lake reservoirs and diversions between Ashton and Rexburg. 32/ Change in storage in Mackay Reservoir, and diversion in Sharp Ditch. 33/ (Combined flow Big Wood River nr. Bellevue and Camas Creek nr. Blaine.) 34/ Change in storage in Arrowrock, Anderson Ranch, and Lucky Peak. 35/ Change in storage in Cascade and Deadwood reservoirs. 36/ Change in storage in Keechelus, Kachess, and Cle Elum reservoirs plus diversion by Kittitas Canal. 37/ (Corrected to natural flow). 38/ Change in storage in Merwin, Yale, and Swift reservoirs. 39/ (Corrected for upstream impairments).

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